TELECOMMUTING: THE WORKPLACE OF THE 90'S

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ABSTRACT

The federal government, like industries in the private sector, has the ability to offer its employees flexible work arrangements. One arrangement which is becoming increasingly popular is telecommuting, where employees work for a portion of the week from home or an alternate remote location. As computer awareness, network access, and the World Wide Web are adopted into the mainstream, more and more employees in both the public and private sectors are finding that the tools necessary to successfully telecommute are easily within their reach. Although not every occupation is compatible with telecommuting, SAS® programmers in particular can benefit from a variety of resources which allow remote access to data and programs.

INTRODUCTION

The U.S. General Services Administration (GSA) defines telecommuting as "a means of performing work on a regular basis in a location other than the principal office, either at home or at a nearby telecenter" [1].

On July 11, 1994 and June 21, 1996, President Clinton issued two memoranda directing each executive department and agency to support the expansion of flexible, family friendly work arrangements [2]. Following these memoranda, The President's Management Council (PMC) endorsed a National Telecommuting Initiative (NTI) to promote greater use of home based telecommuting and telecenters by federal employees [3].

The Initiative calls for increasing the number of federal telecommuters from the 1998 level of approximately 60,000 employees to 160,000 by the end of fiscal year 2002. According to the GSA, this level of participation has the potential to generate facility cost savings of $2 billion annually.

Reduced operating costs are only one of the many benefits of telecommuting. This paper discusses the advantages of telecommuting, pertinent telecommuting concerns, and basic startup recommendations. Resources which promote telecommuting for SAS programmers at The National Institutes of Health, as well as associated World Wide Web resources are provided[1,2].

TELECOMMUTING OPTIONS

For federal employees and commissioned corps officers, the Flexible Workplace Arrangements Program (FWAP) allows employees to either work at home or from one of the established telecommuting centers near their homes [4].

- Work at Home - The most popular form of telecommuting. Employees conduct business from home one or more days per week.

- Telecommuting Center - A multiagency facility which is equipped with computers, office equipment, and copiers for those who drive long distances between their homes and official worksites.

In addition to these options, private sector companies such as AT&T® [5] and Pacific Bell® [6] have also made the following telecommuting choices available:

- Satellite Office - A remote office location for employees of a single company to share. This remote office is usually located close to a concentration of employee residences to reduce travel time and expense to and from the main office.

- Virtual/Mobile Office - Employees are equipped with all the tools and technology necessary to perform their duties from home or on the road (e.g. another office, customer location, airport, etc.).

- Hoteling - Shared company office space designed for drop in use. The space is generally equipped with standard office equipment and employees can either reserve a space or drop in as needed.

WHY TELECOMMUTE?

Nontraditional office arrangements have numerous advantages not only for employees, but for management and the environment as well. Government [1], [7] and private industry [5],[6], [8] web resources agree that telecommuting has the following advantages:

- Provides Financial Savings - Employees save money related to commuting expenses (e.g. fuel, parking, clothing, and eating out). Employers reduce overhead costs and may even be able to reduce/reorganize existing office space.

- Conserves Energy - Fewer automobiles during rush hour reduce traffic and parking congestion, energy consumption, and lower emissions for the environment.

- Improves Health - Employees benefit from less stress related to long rush hour commutes. Reduced traffic on highways leads to fewer accident related injuries.

- <u>Provides a Better Balance</u> - Telecommuting provides a better balance between family and work demands. Time spent commuting can be spent with family instead. Workers have the flexibility to modify their schedules to meet the demands of ill family members or to work at home when they are too ill to travel to the office.

- <u>Improves Productivity</u> - Fewer distractions, meetings and unplanned interruptions lead to greater productivity, which in turn, leads to greater employee morale.

- <u>Allows for Employment Flexibility</u> - Disabled or ill personnel (e.g. those undergoing pregnancy restrictions, medical treatment, etc.) can be accommodated instead of being forced to use disability leave or early retirement.

ISSUES OF CONCERN

Although telecommuting has many advantages, participants and employers should be aware that it also has potential pitfalls [6].

<u>Supervisory Concerns</u>:

In some cases, employees might be met with management resistance or skepticism. Some supervisors may feel that they cannot properly oversee employees who do not work at the main worksite, or that telecommuting may be a burden on the other employees in the office.

Usually these concerns can be avoided by training and communication mechanisms and by coordinating the number of telecommuters within any one department. It is important to remember that telecommuting should not put extra strain on the workers in the office. Telecommuters should be highly accessible and notify coworkers when they are working outside of standard hours. Managers should also schedule regular meetings with telecommuters to give feedback, discuss problems, or assess new developments.

<u>Employee Concerns</u>:

When considering telecommuting as an employment option, workers need to weigh the following issues:

- <u>24 Hour Office Access</u> - Employees having constant access to the office may labor continuously without breaks or definite start and end times to their day.

- <u>Procrastination</u> - Firm rules are necessary for working at home. Avoid getting involved with household chores, the family, or errands. Set goals for each day and try to avoid getting distracted by other chores.

- <u>Telecommuting is not a substitute for childcare</u>- Make arrangements for someone to care for young children. No one benefits from a parent trying to care for a child and complete office tasks at the same time (e.g. either the work does not get completed or the child does not get adequate care).

- <u>Isolation from coworkers</u> - Feeling out of touch with office routines and news can be avoided by making regular visits to the main office or by keeping in touch with coworkers by phone calls or email.

- <u>Data security</u> - Office files should be stored in a secure (preferably locked) file cabinet. Data should be password protected and secured from tampering. Store electronic documents on office computers or have a backup strategy for these files at home. A sophisticated backup system is not required; a copy of important files on a floppy or Zip® disk will provide great insurance against accidental deletions.

- <u>Practice good computer security awareness</u>- Employ virus protection software, use passwords to access hard drives and sensitive data, and use encryption software to send sensitive or critical information by email [9].

- <u>Lack of office support services</u>- Secretarial support, the copy machine, or office supplies will probably not be as accessible from home. The lack of these items or services can be avoided by good planning (e.g. keep extra fax and printer supplies on hand, use copy and secretarial support when in the office, or use your fax machine for small copy jobs).

- <u>Be flexible</u> - It is essential to be flexible in your telecommuting routines. Don't insist on trying to work from home on a day when working from the office is more efficient.

WHO SHOULD TELECOMMUTE?

The Office of Personnel Management has set important guidelines suggesting who should be considered for telecommuting. Permission to telecommute should not be based on the employee's job title, type of appointment or work schedule. Work which is conducive for telecommuting are positions which require thinking and writing, such as data analysis and computer oriented tasks, telephone intensive tasks, case reviews or report writing. These types of jobs usually involve less face to face communications and have clearly defined tasks, work products, or objectives.

On the other hand, work that involves extensive face to face contact with other employees, a supervisor, or the general public may not be suitable. Working from home may also be unrealistic if the employee needs frequent access to files or materials that cannot be accessed electronically, moved from the main office, or the data require a high level of security that cannot be duplicated in a home environment [7].

GETTING STARTED

The first decision a potential telecommuter must make is whether working from home (or an alternate site) is an appropriate choice. Telecommuting requires dedication and hard work and it decreases the amount of available supervision and feedback from others. Teleworkers should be able to make independent decisions and adjust to a certain amount of social isolation. They should also maintain good organizational and time management skills, and be self-motivated. [10].

For those who decide to try telecommuting, the next step is to contact your personnel office to see what procedures are necessary for obtaining the proper approval. In the federal government, each agency sets up its own approval process and usually the employee's immediate supervisor assesses and grants permission for the request [7]. If the request is granted, typically the employee is asked to sign a written agreement designating terms such as work schedule, number of hours, equipment, supplies, compensations and cancellation policies [11].

ORGANIZING A HOME OFFICE

For those planning to telecommute from a home office, it is important to take some time to think about your office and communications setup. The AT&T Telework Guide [5] and Pacific Bell Telecommuting Guide [6] are excellent resources for the beginning telecommuter. Both WWW (World Wide Web) resources offer detailed information on equipment and services available to work from home.

The basic equipment for any home office includes:

- Comfortable seating and an appropriate work surface. Since you will be spending a lot of time in your home office, a comfortable chair that is adjustable and ergonomically correct is essential. Designate a specific location for your office. The kitchen table or other central activity location is not recommended.

- Good lighting. Good lighting will avoid eye fatigue, strain and headaches.

- Personal computer or workstation. Obtain access to the computing resources you need to do your job (e.g. either similar equipment and applications in the home office or remote access to computers and applications running from the main office).

- Printer. The need for a printer will depend on how often you print and how many days you plan to telecommute. If the need to print is low, printing can be deferred until the next time you are in the main office.

- Modem. A telecommunication device that allows your PC (personal computer) to communicate via a phone line. This will be your primary communication link to the main office. A modem will connect your PC to a remote computer, an office LAN (Local Area Network), online services, or email services.

- Fax Machine or Fax Modem. Modems with faxing capabilities allow you to fax documents directly from your PC to the main office. Stand alone fax machines are a useful convenience as they allow faxing of all document types, regardless of origination, and often have the added convenience of built in copy features.

- Additional Phone Lines and Services. The addition of a second phone line may make connecting to your office from home more convenient. By installing a second line for an analog modem, you can still receive phone or fax messages while you are connected to the office. (For more information and additional telecommuting services contact your local phone company.)

COMMUNICATION LINKS

When using a computer from home, the telephone line and a modem will most likely be the basis of your communication link [6]. Fortunately due to advances in telecommunications, many of the physical barriers that once required workers to be in their offices have been removed.

The Pacific Bell Telecommuting Guide [6] provides an excellent overview of the typical communications setups available to work from a home office. A summary is provided below:

- **Low End Access** - Terminal access to applications running on a central computer. Requires a personal computer with terminal emulator software and a modem. Most analog modems can reliably transfer data at a rate of 26 to 33.6 Kbps (Kilobits per second).

- **Mid-range access**- Primarily terminal access and file transfer. Requires a PC, modem, terminal emulator software, and a file transfer package to move the data to your home PC. Install the same applications on your home PC to manipulate the data after the transfer. File transfers over an analog modem will be much slower than transfers made from an office ethernet connection. Noise on your residential phone line may interrupt data transfers, necessitating several transfer attempts. This can be very frustrating if you intend to move large data files on a regular basis.

  Remote access software - Remote access software for the Macintosh® and PC [12] allows your computer to communicate with a compatible server over standard telephone lines giving you direct access to the resources at a remote location. Remote control software such as Timbuktu® Pro is available for users who need to

control the desktop of another computer from home (e.g. great for those who need to administer databases and/or applications remotely).

- **High End Access** - Regular transfers of large amounts of data necessitate a high speed digital communications link [13], [26]. Where available, some of the more popular residential high speed links include:

ISDN - Integrated Services Digital Network is a three channel digital line (two working B channels, 64 Kbps per channel, each with their own phone number and one administrative D channel) that supports concurrent data, voice, and video transmission over one phone line. Typically ISDN is a cleaner connection that doesn't suffer from the standard noise problems of residential lines. Data transfer speeds range from 64 to 128 Kbps (twice the speed of a 56K analog modem).

ADSL (also known as DSL) - A high speed digital link based on Asymmetric Digital Subscriber Line technology. This service provides a dedicated residential link to the internet and remote LANs that is 12 to 125 times faster than a 56 Kbps analog modem (downloads at 640 Kbps to 7 Mbps, uploads at 90 to 680 Kbps) . ADSL expands the power of your existing phone lines by using a portion of the line not utilized by voice for a dedicated link. ADSL is a direct connection to your internet service provider and has the highest upload and download transfer rates. Due to distance limitations of the ADSL technology, service is still very limited in many residential areas.

Cable Modem Services - New broadband services becoming available through local cable companies. This is a high speed network (twelve times faster than a 56 Kbps analog modem) with download speeds up to 700 Kbps transporting voice, interactive video and data services. Bandwidth is shared between neighbors (e.g. cable modems on the same node can cause congestion) so connection speeds may vary depending on the number of simultaneous connections and activity on the line. In Montgomery County Maryland, where NIH is located, cable modem service requires a cable modem, an analog modem, a network card, and a phone line. Data is downloaded via the cable modem at speeds of up to 700 Kbps, however, uploads are still dependent on analog modems at speeds of up to 33.6 Kbps. Upload speeds are expected to improve dramatically when the system is upgraded to a bi-directional cable service in several years .

NIH RESOURCES

The National Institutes of Health (NIH) readily supports the President's Telecommuting Initiative to make work at home strategies more accessible to federal employees [14]. Two services which provide NIH employees with the connections they need to do their jobs from remote locations are NIH PARACHUTE and NIH SILK Web Services. PARACHUTE is a telecommunications service which provides NIH employees with a means of connecting to the NIH network and the WWW remotely. NIH SILK is a web service that provides secure data access and delivery.

NIH PARACHUTE

PARACHUTE is a remote access service (available to NIH employees only) provided by the Center for Information Technology (CIT) branch which allows NIH staff access to campus computing resources (e.g. NIH LAN, the internet, NIH servers and printing facilities, and email) from off campus using either a standard or high speed digital connection [15].

PARACHUTE is an acronym for PPP and Apple Remote Access Central High-Speed User Telecommuting Engine. PARACHUTE has been available to NIH employees since January 1996 and gives remote users the same access to network services as employees on the NIH campus at either standard or high modem speeds [16].

For NIH employees, getting connected from home is a simple process. The first step is to contact CIT (301-594-6248 or http://cit.nih.gov) to apply for a PARACHUTE account. Once accepted, the employee receives a User Name and Password which is necessary to configure and authenticate the account [15]. The final step is to install and configure a modem for your home computer (minimum 33.6 or 56 Kbps analog modems recommended).

The Center for Information Technology is continuously evaluating new services and devices to make remote connections for NIH employees more efficient. CIT has recently implemented 56Kv.90, ISDN, and Cable Modem Services for NIH Parachute members. A DSL pilot program is also in effect to determine the effectiveness of this technology on boosting the speed of remote access connections to NIH [26].

NIH SILK

In January 1997, The Center for Information Technology introduced **S**ecure **I**nternet-**L**in**K**ed web technology on the NIH campus (SILK) [17]. The SILK web technology allows NIH employees to create and maintain their own web servers. SILK is a convenient means by which NIH employees can easily access and display information to others in their group. The benefit of SILK is that users can post their own data, reports or output on the web, instead of distributing hard copy versions to coworkers. This is particularly useful for remote workers since the distribution of hard copy reports would soon become costly (e.g. postage) and inefficient (e.g. the data could become outdated before it is received). An additional benefit to SILK users is that CIT handles all the server hardware, software, security, and maintenance.

Users of the SILK web services can easily display MVS SAS data and output for colleagues by saving the output with the following syntax:

aaaaiii.@www.filename

The SILK system allows immediate web access to virtually any type of data (e.g. text, HTML, GIF, JPG). Users with CIT accounts can choose to serve data from either a public server (http://silk.nih.gov/public/, accessible by anyone), or a secure server (http://silk.nih.gov/secure/) that takes advantage of the MVS RACF (Resource Access Control Facility). Files saved with RACF protection, which restricts access to specific individuals or groups, access their files via the secure server, whereas, all unprotected files are accessed by way of the public server [18].

NIH has a number of facilities on SILK available to employees with CIT accounts that are advantageous to those who perform their jobs remotely [19]. (For a complete list of SILK resources see Table 1.)

SAS RESOURCES

The SAS System offers several types of remote access solutions for programmers who wish to complete their assignments from locations other than the main office. SAS/CONNECT® Software and SAS/SHARE® Software are two client-server products which allow users to connect to the computing and data resources of the SAS System from their local desktops. Based on the client-server model where a first process requests data or services from a second process executing on a remote machine, both products are particularly useful for employees who wish to access SAS resources from their home or another remote location.

SAS/CONNECT SOFTWARE

SAS/CONNECT software is a data access tool used to connect two SAS sessions on different computers. This product allows you to connect to multiple remote SAS sessions, process applications, access data from a remote SAS session on your local machine, and to combine SAS data from incompatible systems into one data set [20].

SAS/CONNECT Software consists of two main services, *compute services* and *remote data services*. The compute services consist of remote session processing (RSUBMIT and RSPT), whereas the remote data services consist of data transfer (UPLOAD and DOWNLOAD) and remote library services (LIBNAME).

In a typical SAS/CONNECT session a link is established between two SAS sessions running on different hosts. Once the connection is established the user has access to the services and resources available to both sessions.

As a remote access tool SAS/CONNECT can be extremely useful as it allows telecommuters to utilize a variety of resources not available on their local desktops. Some advantages of SAS/CONNECT software are:

- Allows access to other SAS licensed products (e.g. SAS/STAT®, SAS/GRAPH®) on remote systems that are unavailable on the home system.

- Large amounts of data can be processed more efficiently at the office, eliminating transfer time to the local desktop.

- Dynamic or frequently updated data need not be continuously transferred to the local desktop for analysis.

- Multiple SAS files can be transferred in a single step.

- SAS files can be seamlessly moved between releases or across operating systems.

(For a complete explanation of this product, see SAS/CONNECT Software, Usage and Reference [20].)

SAS/SHARE SOFTWARE

Another remote access solution from SAS Institute is SAS/SHARE software. This product is often employed when multiple users need to update the same SAS data libraries or SAS files concurrently. Generally, the file systems on most operating systems prevent multiple users from accessing or making changes to the same file. However, through the use of SAS/SHARE software, the same libraries or files can be modified while ensuring that inconsistent changes are not made or important new information is not overwritten [21].

Several advantages to SAS/SHARE software have been noted by Aster [21]:

- Multiple users can modify or update separate observations in a SAS data set or catalog.

- The software works without modifying current SAS programs.

- SAS/CONNECT and SAS/ACCESS® software can be employed in combination with SAS/SHARE software.

- SAS/SHARE allows file sharing between the MVS and CMS operating systems.

SAS WEB TOOLS

Within the last few years, there has been an explosion of Web products designed to make remote access to information and services more convenient. Many private companies and government agencies have their own web sites displaying static information and internal intranets containing information and services for employee access.

The Web is a universal interface for distributing information in a timely and efficient manner. Today, web browsers work on most operating systems and users need

only learn minimal skills (e.g. pointing and clicking) to utilize resources posted on the majority of web sites. SAS Institute has developed a full range of web solutions ranging from static information delivery (Web Publishing Tools) to web applications allowing users to generate dynamic information on demand (SAS/IntrNet™ Software) [22].

Web Publishing Tools
Of the SAS Web Publishing Tools available to date (See Table 2), the HTML (Hypertext Markup Language) Formatting Tools have assisted SAS users in delivering static data and reports in a timely manner.

There are three types of SAS HTML Formatting Tools:

- HTML Output Formatter -
  saves output from any SAS procedure to a HTML file.

- HTML Data Set Formatter - converts SAS data sets to HTML 3.x tables.

- HTML Tabulate Formatter - Converts Proc TABULATE output into HTML 3.x tables.

No knowledge of HTML is required to use the SAS HTML Formatting Tools. This collection of web tools (available for Windows, MacOS, Unix, OpenVMS, and MVS systems) allows users to easily create SAS output with valid HTML tags (not just output surrounded by the <pre> tag). Each of the formatting tools is written as a SAS macro which defines a set of properties to format the text of the output. Either the default properties can be used or users can customize their own properties [23].

SAS/IntrNet™ Software
SAS/IntrNet™ software is a set of dynamic applications that allows users to create and deploy web enabled applications providing remote access to data and computing power from any desktop, regardless of whether SAS software is locally installed.

SAS/IntrNet™ consists of ten components which can be used alone, or combined to provide a solution that best meets the needs of your organization. The SAS Web Tools Product Index [22] and SAS/IntrNet™ Software: Delivering Web Solutions [24], provide a detailed overview of the suite of tools outlined in Table 2.

Two of the more popular SAS/IntrNet™ components are the Application Dispatcher (a compute service) and htmSQL (a data service). Both products use the Common Gateway Interface (CGI) technology, which is a programming interface that resides on a web server and communicates with an external program when a request is submitted via a web browser (CGI URL).

The Application Dispatcher
The Application Dispatcher is a powerful report distribution and analysis tool. It allows programmers to build a web application that accesses and deploys a SAS program,

which can be available to any number of users, even though SAS software is not installed on the desktop. The Application Dispatcher consists of:

- An HTML Formatted Web Page -
  a HTML form, a hypertext link to the Application Broker, an inline image, or an object (e.g. a Java™ applet, ActiveX™ control, or Plug-in), that sends an immediate request to the Application Broker.

- Application Broker - a CGI program that resides on a Web server and interprets a form request and passes it to the Application Server.

- Application Server - A SAS session that receives and processes information from the Application Broker. Results are sent back to the Broker, which in turn, sends the results back to the user's Web browser.

- Dispatcher Applications - SAS code (a program, source entry, SCL entry, or compiled macro) which accepts the form information that is passed from the Application Broker.

To effectively use The Application Dispatcher, one should be skilled in HTML and SAS programming [24].

htmSQL
HtmSQL is a popular data service component of SAS/IntrNet™ software. It is also a CGI program which resides on a web server and can be used to access and modify SAS data from a web page. To use htmSQL the programmer provides an input file which contains SQL (Structured Query Language) queries imbedded in the HTML. The htmSQL tool then formats the query results based on the programmers instructions. The main advantage to this solution is that each web query is dynamically processed so the displayed results always contain the most current data.

For htmSQL the critical element is the input file. This file creates the application interface, defines the SQL queries, and specifies how the results are displayed. The query section of the input file generally contains the following:

- sql section - specifies the SQL query that is sent to the SAS server.

- eachrow section - describes how to display the results of the query.

- norows section - designates application behavior when a query does not return any rows.

To effectively use the htmSQL tool, users should be familiar with HTML and SQL.

Again, these are simply a selection of several of the SAS Web Tools components. For a detailed explanation of the available products, as well as demonstration programs,

platform availability, and instructions for use, readers should refer to the online SAS Web Tools documentation [22].

CONCLUSION

Never before has there been so many resources and solutions for employees wishing to work remotely. Telecommunications innovations such as high speed digital links are becoming available to more and more residential areas so employees can access data at more efficient speeds. Employers are providing services which promote easy access to work, the network, software and data (e.g. NIH PARACHUTE and SILK). Companies such as SAS Institute continue to develop web based applications (e.g. Web Publishing Tools and SAS/IntrNet™ Software) providing platform independent, secure applications for accessing and publishing data.

With today's technological innovations, most work no longer needs to be location sensitive. Telecommuting has redefined the workplace we once knew. The NIH Office of Telecommunications Management has wisely noted that employee contributions should not be measured by where a person sits, but by the value that employee brings to their organization [25].

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TRADEMARKS

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NOTE

[1]This paper was previously presented at SUGI24, Miami, Florida. See Mallus, T.T. (1999). Telecommuting: The Workplace of the 90's. Proceedings of the Twenty-Fourth Annual SAS Users Group International, 24, 1270-1275.

[2] This paper was previously presented at NESUG98, Pittsburgh, Pennsylvania. See Mallus, T.T. (1998). Telecommuting: The Workplace of the 90's. Proceedings of the Eleventh Annual Northeast SAS Users Group Conference,11, 541-550.

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Table 1. NIH SILK Web Facilities

NIH SILK Web Facilities	Description	URL
Customized SILK Servers—Management	Create/manage customized web servers.	http://silk.nih.gov/msilk/
SILK Locator* (No CIT Account required)	Search for specific SILK web servers and their owners.	http://silk.nih.gov/locator
Web RACF	SILK server owners designate security for their data sets.	http://silk.nih.gov/racf
Web Sponsor	Sponsors open, display and modify new/existing computer accounts.	http://silk.nih.gov/sponsor/homepage
Web Listoff	List contents of data or programs via web interface.	http://silk.nih.gov/listoff/
Web Submit	Submit MVS batch jobs via the web.	http://silk.nih.gov/submit/
Easymail	Send email without having email software installed on your computer.	http://silk.nih.gov/easymail/
Formsmail	Send web form information to a designated email address.	http://silk.nih.gov/formsmail/doc
Database Technologies (DB2® and Oracle®)	Access NIH DB2 and Oracle technologies.	http://silk.nih.gov/dbtech/
NIH Backup And Recovery Service (NBARS)	NIH Backup And Recovery Service information.	http://silk.nih.gov/silk/NBARS/
Human Resources Information and Benefits System (HRIBS)	NIH employee benefit information accessible via the web.	http://silk.nih.gov/hribs/display

Table 2.   SAS Web Tools

SAS/IntrNet™ Software	Description	URL
Application Dispatcher	Web gateway providing data access, analysis, and presentation procedures.	http://www.sas.com/rnd/web/dispatch/index.html
MDDB Report Viewer	Multidimensional database (MDDB) report and graphics generator and viewer.	http://www.sas.com/rnd/web/mddbapp/index.html
htmSQL	A CGI program that performs SQL queries and updates. Returns the results in HTML.	http://www.sas.com/rnd/web/htmSQL/index.html
SAS SQL Library for C	A library of C functions used to send SQL queries to remote hosts.	http://www.sas.com/rnd/web/sasSQL/index.html
SAS/SHARE Driver for JDBC	Access and update SAS data via Java programs.	http://www.sas.com/rnd/web/java/jdbc/index.html
SAS/CONNECT Driver for Java	Java classes communicate with a SAS session.	http://www.sas.com/rnd/web/java/jconnect/index.html
Tunnel feature	Addresses common Java Applet configuration problems.	http://www.sas.com/rnd/web/java/tunnel/index.html
Metaspace Explorer applet	Java applet that allows browsing of information contained in a data warehouse.	http://www.sas.com/rnd/web/java/jwn/index.html
Connection Wizard	Provides Web access to a SAS/CONNECT session.	http://www.sas.com/rnd/web/java/jwn/cwiz/index.html
Xplore	Dynamic access to SAS data for drill-down Web analysis.	http://www.sas.com/rnd/web/xplore/
Web Publishing Tools		
Appllication Utilities	Web enablement utilities which perform data set conversions, serve files, and encode and decode character strings.	http://www.sas.com/rnd/web/misc/apputil.html
SAS Automation Plugin	Enables a push button on a web page to perform a SAS action.	http://www.sas.com/rnd/web/plugin/index.html
GIF and IMGGIF Drivers	Support the creation of GIF images.	http://www.sas.com/rnd/web/driver/GIF/index.html
GIFANIM Driver	A mechanism to create animations.	http://www.sas.com/rnd/web/driver/GIFANIM/index.html
SAS IMGJPEG Driver	Produces output in the JPEG File Interchange Format.	http://www.sas.com/rnd/web/driver/JPEG/index.html
HTML Formatting Tools	Formats SAS data or output in HTML.	http://www.sas.com/rnd/web/format/index.html
GraphApplet	Provides thin-client interactive graphics.	http://www.sas.com/rnd/web/graphapp/index.html